PHY 2032: Energy and Society
Quest 2

I. General Information

Class Meetings

- Semester: Spring 2025
- Course number 22381, Section number 1082
- Meeting Day/Time: Tues. 4th period (10:40-11:30pm), Thurs. 4-5th periods (10:40-12:35pm)
- NPB 1002

Instructor

- Instructor: Prof. Shawn Weatherford, sweatherford@ufl.edu (preferred method of communication outside class time)
- Office location: 2142 NPB
- Office hours: Tues 5th Period & Thurs 6th Period. Appointments can always be made for times outside of the regular office hours.
- Phone: (352) 392-8747

Course Description

How will we meet our energy needs based on available resources in a way that is environmentally friendly, economically viable, fair, and politically attainable?

This course addresses the question of what energy usage will be in the both the short and long term based on availability of resources, technology, environmental concerns, economics, personal choices, and national and international policy. The course will provide the background in science, technology, the environment, natural resources, economics, and policy so that students can make their own decisions as to what their and the world's energy future will be. As part of the process students will develop the quantitative reasoning skills necessary to make informed policy decisions and learn to communicate their ideas clearly.

The course starts by introducing the scientific basis for energy and reading in parallel a historical account of energy usage. Energy played a central role in how society developed. Many of the concerns that one sees now in terms of availability of natural resources and environmental impact have arisen throughout history. Students will develop quantitative reasoning skills by tackling energy related problems. The math involved is only basic arithmetic, but students will be asked to explain in writing their reasoning. Following this initial stage, the course will address in turn energy technologies, environment concerns both today and in the past, the economics of energy costs, personal choices that we make and that people in different countries make, national energy policies, and international policies and politics. At

the end of the course, students will write a white paper proposing a particular energy solution that may be either at the personal, local, national or international level.

Quest and General Education Credit

- Quest 2
- Physical Sciences

This course accomplishes the Quest and General Education objectives of the subject areas listed above. A minimum grade of C is required for Quest and General Education credit. Courses intended to satisfy Quest and General Education requirements cannot be taken S-U.

Required Readings and Works

Richard Rhodes, "Energy: A Human History," Simon and Schuster, New York, NY (2018).
David J.C. MacKay, "Sustainable Energy – Without the Hot Air," UIT Cambridge Ltd, Cambridge, UK (2009). This book is available for free on-line from https://www.withouthotair.com/ .
William Kamkwamba and Bryan Mealer, "The Boy Who Harnessed the Wind," Harper Collins, New York, NY (2009).

Materials and Supplies Fees: n/a

II. Graded Work

Description of Graded Work

Work	Description	Word Count	Percentage
In-class work	During nearly every class, students will be asked to submit responses to questions or worked problems or even a short quiz on the reading. In the second period on Thursdays, the work submitted will often be for a group of students. The grading for these activities will be based on making a good faith effort to solve the problem. Simply submitting a one or two word answer or just a number will not result in any credit; however, considering that the instructor will be available to assist you, it is expected that most grades will be for 100% for this portion of the grade. The answers to questions and responses must be expressed in full sentences.		10
Homework	There are 10 weekly homework assignments, which are due on Tuesdays except HW 10, which is due on a Thursday. The homework assignments consist of problems, questions about the readings, and lab reports. The format of the homework each week is indicated in the following pages of the course schedule.	estimated 2000 words total	30

	Unlike those in a typical Physics class, most problems do not have a single correct answer. Rather students are expected to list the assumptions for their calculation, explain the calculation, and then present their conclusions – all in full sentences. In many ways this is a class on quantitative reasoning. The readings during the first 10 weeks of the course are spaced so as to maintain an even workload. To ensure that you keep up with the readings, there will be a weekly prompt or question on the reading. The lab reports are specific to each lab. They will be started in class and submitted in final form the following Tuesday.		
Exam 1	One-period exam based on material covered in class from Jan. 13 through Feb. 11. A sample exam will be placed on Canvas prior to the in-class exam.		20
Exam 2	One-period exam based on material covered in class from Feb. 13 through Mar. 25. A sample exam will be placed on Canvas prior to the in-class exam.		20
Final Project	After homework 10, the focus will be on the final project, which is to write a white paper promoting an energy solution at the personal, national, or international level. The proposal must use some material discussed in the class as well as some new data that the student has found on their own, include at least one quantitative calculation presented in a logical manner from start to finish, and have a clear concluding call to action. Students must also address how this proposal will affect them personally. There will be a workshop in class to develop an abstract and an outline, and another workshop in class to comment on a draft. Both the abstract/outline and drafts will be handed in for instructor comment as well.	2000	20

Grading Scale

For information on how UF assigns grade points, visit: https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/

A	94 – 100%		C	74 – 76%
A-	90 – 93%		C-	70 – 73%
B+	87 – 89%		D+	67 – 69%
B	84 – 86%		D	64 – 66%
B-	80 – 83%		D-	60 – 63%
C+	77 – 79%		E	<60

III. Annotated Weekly Schedule

Date	Topic	Description	Reading Before Class	Assignment Due
Science				
Tues. Jan. 14	Course Introduction	After reviewing the syllabus and course structure, we will have several activities: students list different forms of energy; explain how energy as discussed in this course is related to their major and to their Quest 1 course.		
Thurs. Jan. 16, Part 1	Skills	To succeed in this course requires mathematical skills, quantitative reasoning, reading and communications skills. We will do some exercises in groups and individually. This is not remedial. I am still learning and improving with some of these.		
Thurs Jan. 16, Part 2	Philosophy of Science	We will perform a task that draws direct comparison to the practice of science by a community of individuals. From this we will explore the fundamental principles on which our scientific knowledge is built.		
Tues. Jan. 21	Energy Units	We will have a very short quiz to test reading comprehension (not for credit) and then have a discussion on what happened, why is it significant, why is it import for me. Then I will introduce the many energy units, and we will start doing problems.	Rhodes: Chapters 1-3 (pp. 3-48) [Beginning Industrial Revolution]	Homework 0: Questions on Reading (practice)
Thur. Jan. 23, Part 1	Power	Power is energy per unit time. We will examine the power output and usage of everyday objects: cars, cell phones, lights, … From a historical perspective the need for more power led to the development of steam engines.		
Thur. Jan 23, Part 2	Energy and Power Problems	In small groups students will work problems on energy and power that relate to their everyday lives. Some of the problems have unique correct answers, but many have multiple correct answers. We will compare the results.	MacKay: pp. 68-71 [Gadgets]	
Tues. Jan. 28	Thermodynamics and Latent Heat	Discussion of the different types of steam engines covered in the reading. Analysis of them in terms of the physics, particularly the laws of thermodynamics and latent heat.	Rhodes: Chapters 4-6 (pp. 49-104) [Steam Engines]	Homework 1: Problems, Self-reflection, Questions on Reading

Date	Topic	Description	Reading Before Class	Assignment Due
Thur. Jan. 30, Parts 1&2	Quantitative Latent Heat Lab	Quantitative lab where students measure the latent heat needed to melt ice using calorimeters. Systematic and random errors in making the measurements are estimated. A lucky few will get to try some homemade ice cream (thanks to the latent heat of ice).		
Tues. Feb. 4	Scientific method, electricity	The numbers in the lab last week did not work out exactly as expected. We will see how science works with quantitative measurements and what can go wrong such as in the "Cold Fusion" experiments. Begin discussion of electricity.	Rhodes: Chapters 11-12 (pp. 168-206) [Electrification]	Homework 2: Lab Report, Questions on Reading
Thur. Feb 6, Parts 1,2	Design Challenge Lab	Qualitative lab where student explore the properties of electrical circuits with LED's and generators, and then design a windmill generator. Through trial and error students try to make the windmill that generates the most current.		
Technology				
Tues. Feb. 11	Electricity, Lab Discussion	Discussion of the results of the qualitative lab and then continue with electricity. In particular Faraday's law is the basis for almost all electrical generators. Finish discussion of electricity from Chapters 11-12.	Rhodes: Chapters 7-10 (pp. 105-167) [Lighting] MacKay: pp. 57-59 [Lighting]	Homework 3: Lab Report, Questions on Reading
Thur. Feb. 13, Part 1	Lighting	A central theme in the historical reading is the search for better lighting: wood burning, oil burning, gas lights, and incandescent light bulbs. Discuss these as well as the blue LED, for which the 2014 Nobel prize in physics was awarded.		
Thur. Feb. 13, Part 2	Exam 1	This exam will cover all material up through Tues. Feb.6. A sample exam will be made available in Canvas.		
Tues. Feb. 18	Energy Density and Storage	The concept of energy density is introduced and applied to transportation and to the the human diet. Oil, discussed in the reading, is very energy dense. Energy storage is a crucial technology for using renewable energy.	Rhodes: Chapters 15-16 (pp. 229-271) [Oil] MacKay: pp. 76-79 [Food] MacKay: pp. 186-201 [Storage]	Homework 4: Questions on Reading

Date	Topic	Description	Reading Before Class	Assignment Due
Thur. Feb. 20, Part 1	Engines and Efficiency	The internal combustion engine and the electric motor will be explained, including the concept of energy efficiency.		
Thur. Feb. 20, Part 2	Energy Usage in Transportation	Group work: What are the most efficient forms of transportation? How much energy does a car use compared to a person walking or an airplane? Students will study these questions using a work-sheet and then discuss their own transportation energy usage.	MacKay: pp. 29-30 [cars]MacKay: pp. 35-36 [Planes]MacKay: pp. 118-134 [Transportation]	
Tues. Feb. 25	Nuclear Energy	Nuclear energy, covered in the reading, does not produce greenhouse gases, but there are environmental risks in usage and in waste storage. We will review and discuss the benefits and drawbacks of using nuclear energy.	Rhodes: Chapters 17-20 (pp. 272-344) [Nuclear Energy and Future] MacKay: pp. 61-173 [Nuclear]	Homework 5: Problems, Reflection Question, Questions on Reading
Environment				
Thur. Feb. 27, Part 1	Greenhouse effect, Comparison of Moon and Earth	Why is the moon colder than the Earth on average although they are basically the same distance from the sun? To understand this question and the greenhouse effect, we examine energy flow into and way from the Earth.		
Thur. Feb. 27, Part 2	Experimental Evidence for Climate Change	We will take a close look at real data indicating climate change and the cause of climate change. Students will draw their own conclusions. We will also develop skills in reading complex scientific graphs by doing some group exercises.	MacKay: pp. 3-18 [Climate Data]	
Tues. Mar. 4	Energy and the Environment in Historical Context	For the reading for this week and in most of the other weeks there was an environmental consequence either motivating an energy change or because of an energy change. Students list and discuss these consequences.	Rhodes: Chater 13-14 (pp. 207-226) [Black Clouds]	

Date	Topic	Description	Reading Before Class	Assignment Due
Thur. Mar. 6, Part 1	Waste in Energy Production	Mining, drilling, making solar cells and creating dams all have potential damaging consequences. This session will ask student to think critically about the pros and cons of different energy sources.		
Thur. Mar. 6, Part2	Communicating Science to the Public	How does one best convey scientific results to the public? Why do some views persist even in the face of scientific evidence? Students in small groups and with the class as a whole will examine these questions.		
Energy Resources				
Tues. Mar. 11	Worldwide Nonrenewable Resources	On Earth we have a limited supply of nonrenewable resources like fossil fuels. Using current estimate from US and international agencies, how long will those supplies last? This will be good practice reading scientific graphs and charts.	Kamkwamba: Chapters 1-5 (pp. 3-97)	Homework 6: Questions on Environment and Energy in context of readings
Thur. Mar. 13, Part 1	Worldwide Renewable Resources	How much energy is produced by renewable sources today and how much can be produced in the future? Again we will use official statistics to draw our own conclusions.	MacKay: pp. 32-34, 38-44, 55-56, 60-63, 103-112 [Renewable energy sources]	
Thur. Mar. 13, Part 2	UF Energy Tour	Energy infrastructure is all over campus - it just may not be apparent. We will do a walking tour starting from our classroom looking at chilled water coolers, transformers, etc. and also discuss UF's energy plan		
Mar 17-22	Spring Break			
Economics				
Tues. Mar. 25	Global Politics	Energy resources are bought and sold on a global scale. Energy influences global politics, and global politics influences energy production and sale. The link between energy and global politics will be explored from a historical perspective up until the present.	Kamkwamba: Chapters 6-10 (pp. 98-193)	Homework 7: Question on Communicating Science, Questions on Reading

Date	Topic	Description	Reading Before Class	Assignment Due
Thur. Mar. 27	Exam 2	This exam covers the material covered since Exam 1 through Tues. Mar. 24. A sample exam will be made available in Canvas.		
Personal Choices				
Tues. Apr. 1,	Workshop on Final Project	Students will bring a general idea for their final project to class. This idea will be refined working individually and in small groups	Kamkwamba: Chapters 11-15 + Epilogue (pp. 194-286) MacKay: pp. 50-53 [Heating/cooling]	Homework 8: Self-reflection Question, Questions on Reading
Thur. Apr. 3, Part 1	Energy Costs at National and International Level	How much money is spent on energy in the US, in total and per capita? Compare with other countries. This again makes heavy use of data and graphs from scientific and government sources.		
Thur. Apr. 3, Part 2	Personal Energy Costs Today	How much do you spend on energy on an average day? Students will work in class to figure this out, and then compare their energy usage to that of William in the book. What are the differences between William's life and their own?		
International Policy				
Tues. Apr. 8	Small Group: Research on NDCs	Almost all nations have put forward Nationally Determined Contributions (NDCs) to address changes in policy and goals to mitigate climate change. Small groups of students will be responsible for learning about NDCs of specific countries.	MacKay: pp. 231-239 [World Usage]	Homework 9: Abstract for Final Project

Date	Topic	Description	Reading Before Class	Assignment Due
Thur. Apr. 10, Parts 1,2	Climate Conference Presentations	Each group will present information about their chosen country in terms of energy use, energy needs, and their NDC. We will have some discussions about which groups of countries align to meet energy goals.		Homework 10: NDC Research
National Policy and Synthesis				
Tues. Apr. 15	Workshop on final projects	Students will bring a draft of their final project paper to class to work on in small groups and also on their own. This is the final tune-up before submission.		Draft of Final Project
Thur. Apr. 17, Parts 1&2	Final project poster presentations	In the first part of the class students will make posters explaining their project on large post-its that will then be placed on the wall. We will then have a poster session, where students share their projects with each other, followed by a group discussion.		
Tues. Apr. 22	Course evaluations and feedback	Both UF and Quest evaluations will be done. Please bring a computer or tablet to complete them. We will also have an exit interview discussion to get ideas for improvement in the future.		Final Project

IV. Student Learning Outcomes (SLOs)

At the end of this course, students will be expected to have achieved the Quest and General Education learning outcomes as follows:

	Physical Sciences SLOs ➔ Students will be able to…	Quest 2 SLOs ➔ Students will be able to…	This Course's SLOs ➔ Students will be able to…	Assessment Student competencies will be assessed through…
Content	**Identify, describe, and explain** the basic concepts, theories and terminology of natural science and the scientific method; the major scientific discoveries and the impacts on society and the environment; and the relevant processes that govern biological and physical systems.	**Identify, describe, and explain** the cross-disciplinary dimensions of a pressing societal issue or challenge as represented by the social sciences and/or biophysical sciences incorporated into the course.	**Identify, describe, and explain** the laws of conservation of energy and thermodynamics, different forms of energy, energy units, and power.	Homework problems and exams.
Content			**Identify, describe, and explain** how environmental concerns, economics, personal choices, national and international policies and politics affects and determines energy usage.	Homework questions on the readings, exam questions, in-class work, and the final project.
Critical Thinking	**Formulate empirically-testable hypotheses** derived from the study of physical processes or living things; apply logical reasoning skills effectively through scientific criticism and argument; and apply techniques of discovery and critical thinking effectively to solve scientific problems and to evaluate outcomes.	**Critically analyze** quantitative or qualitative data appropriate for informing an approach, policy, or praxis that addresses some dimension of an important societal issue or challenge.	**Critically analyze** and **evaluate** quantitative data to draw conclusions and test hypotheses.	Quantitative lab report and problems in homework and exams featuring data.

	Physical Sciences SLOs ➔ Students will be able to…	Quest 2 SLOs ➔ Students will be able to…	This Course's SLOs ➔ Students will be able to…	Assessment Student competencies will be assessed through…
Critical Thinking			**Evaluate** quantitatively energy needs and energy sources so as to **critically analyze** energy policy.	Homework problems and exam questions.
Communication	Communicate scientific knowledge, thoughts, and reasoning clearly and effectively.	**Develop and present**, in terms accessible to an educated public, clear and effective responses to proposed approaches, policies, or practices that address important societal issues or challenges.	**Develop and present** in writing quantitative arguments showing clearly assumptions, logical reasoning, and conclusions.	Homework problems and final project.
Communication			**Develop and present** in writing energy solutions accessible to the public.	Final project.
Connection	N/A	**Connect course content** with critical reflection on their intellectual, personal, and professional development at UF and beyond.	Analyze personal energy usage and its impacts.	Self-reflection homework assignments.
			Develop their own proposal for energy solutions and their own vision for the future.	Final project.

V. Quest Learning Experiences

1. Details of Experiential Learning Component

This class contains three separate experiential learning components. There are two lab experiments and an energy tour.

Quantitative Lab: One of the historical advances in building more efficient steam engines is due to understanding the energy needed to turn water into steam, which is called the latent heat of vaporization. With our regular classroom it is not going to be safe to measure this, but we can measure the latent heat of fusion or the energy required to turn ice into water. In this lab we will use calorimeters to measure the latent heat of fusion and other thermodynamic properties. We will check for agreement between theory and your observations, as well as compare the observations of different groups to gain a better understanding uncertainties in quantitative measurements.

Design Challenge Lab: This is an open-ended lab. You will be given a small electrical generator and asked to construct a windmill generator just as in the book "The Boy Who Harnessed the Wind." You will have to design, build, and test the windmill blades and the support structure. Don't expect everything to work the first time. Having a difficulty or setback and overcoming it is a valuable experience. The instructor will be available to help you. At the end of the class we will have a competition to see whose windmill generates the most power.

Energy tour: Where does the energy come from that runs the UF campus or in your community? Energy infrastructure is all over campus - it just may not be apparent. We will do a walking tour starting from our classroom looking at chilled water coolers, transformers, etc. and also discuss UF's energy plan.

2. Details of Self-Reflection Component

In the context of this course on energy, self-reflection means that students become aware of their energy usage, the choices about energy that they make, and the implications of those choices. Self-reflection questions are included in homework assignments 1, 5, and 8, following and leading up to these discussions in class.

VI. Required Policies

Attendance Policy

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

Students Requiring Accommodation

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

UF Evaluations Process

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Counseling and Wellness Center

Contact information for the Counseling and Wellness Center: http://www.counseling.ufl.edu/ , 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

The Writing Studio

The writing studio is committed to helping University of Florida students meet their academic and professional goals by becoming better writers. Visit the writing studio online at http://writing.ufl.edu/writing-studio/ or in 2215 Turlington Hall for one-on-one consultations and workshops.

In-Class Recordings

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.